MOBBING RESPONSES OF SOME PASSERINES TO THE CALLS AND LOCATION OF THE SCREECH OWL

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Abstract

Tests using 12 nest/roost locations of the Screech Owl (*Otus asio*) and 12 non-nest/non-roost locations in a five-county area of Piedmont North Carolina showed that passerine birds recognize the call of Screech Owls, associate an owl's call with its likely location, and remember the location. Passerines mobbed a speaker playing recordings of Screech Owl calls in non-nest/non-roost locations, but playbacks of calls stimulated orientation not to the speaker but to the nest/roost in known owl locations. In all nest/roost locations, the first bird to respond oriented to the owl cavity. The results suggest that a function of mobbing is to gain information about the predator. Mobbing may have evolved from the fight-flight conflict during encounters with predators into a social display communicating presence and location of a predator.

Introduction

Passerines often mob predators in the wild (Dodsworth 1910, Lorenz 1938, Rand 1941), and owls are the most frequent object of this behavior (Hinde 1966). Bangs (1930), Bent (1938), and Pearson et al. (1959) observed that the Screech Owl is often the focus of mobbing by song birds in North America, especially during the nesting season. The Screech Owl is an opportunistic predator, often taking passerines as a main source of food for its young (Allen 1924, Stewart 1969). Since the nesting season of the Screech Owl coincides with the migration of song birds, the owl has a ready supply of food for its offspring (VanCamp and Henny 1975). This is probably the reason Screech Owls are frequently mobbed.

Visual characters that release mobbing in birds have been studied by Hartley (1950), Hinde (1954), Kruuk (1976), and Smith and Graves (1978). Hamerstrom (1957) found that a fed hawk was mobbed less than a hungry one, suggesting that even subtle visual cues of the physiological state of a predator may have an effect on mobbing song birds.

Auditory cues of predators have been largely ignored in studies of mobbing behavior. Miller (1952) mentioned that prey animals can recognize predators by auditory cues alone. He found that whistled imitations of different predator calls evoked mobbing in passerines.

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While censusing birds with a recording of Screech Owl calls, we observed passerines mobbing a tree cavity located a considerable distance from the source of sound. Here we present results of our tests of the hypotheses that passerines can (1) recognize specific predatory species by calls alone, (2) associate a predator's call with its likely location, and (3) remember the location of the predator. If these hypotheses are true, our understanding of the functions of mobbing in birds could be greatly enhanced. The ability of prey to remember a past location of a predator might give a better understanding of how mobbing behavior has evolved.

Material and Methods

Our study was conducted in a five-county (Lincoln, Catawba, Iredell, Mecklenburg, and Union) area of Piedmont North Carolina. Tests were conducted during daylight from August 1976 to May 1977 in order to obtain data on migrating passerines, permanent residents, winter residents, and nesting birds.

A recording of an Eastern Screech Owl, taken from Wetmore (1965), was duplicated off a master reel onto a cassette tape. Five minutes of continuous Screech Owl calls were given at an average rate of 19 calls per minute. The calls were a series of quavering notes of two types. The first were descending in pitch and the second were a series of monotone notes (Robbins et al. 1966).

A portable cassette player was used for playback. The volume output of the speaker was set uniformly at 87 dB at 1 m using a Sound Level Meter, Model 101-A, manufactured by Advanced Acoustical Research Corporation. At several locations the Sound Level Meter was used to check for uniformity of sound level in the field, and no significant variation was found. To assure that the observer did not affect the behavior of mobbing birds, a portable blind (see LeCroy 1975) was used. A pair of binoculars (7 × 35) aided in the identification of the mobbing passerines.

Our study consisted of 24 tests conducted in two situations. The first was at known nests or roosts of Screech Owls designated "P" ("P" = Screech Owl present). The second situation, which served as the control, was where Screech Owls did not nest or roost. Non-owl areas were designated "O" ("O" = no Screech Owls present). All "P" and "O" tests were matched according to similar habitat, season, time, and weather conditions.

A roost location was one in which an adult Screech Owl perched during daylight hours. Screech Owls use old nest cavities as roosting sites during fall and winter (VanCamp and Henny 1975). Where we had no knowledge of nesting in the location, it was defined as a roosting site. A known nest location was defined as a cavity in which active nesting was observed. A cavity that was used as a nest site by a pair of Screech Owls and later abandoned was defined as a nest location.

Nests were reported to us or found by using the call-back method. At nest locations, owls apparently cannot resist calling back to recordings regardless of the time of day. The call-back method was productive since Screech Owls tend to be highly territorial except during December and January (Hough 1960). If calling was heard, we searched the area for a cavity tree. Roost sites were found by hearing owls call from a location and finding the owl at that location on more than two consecutive occasions.

Tests were conducted in 12 "P" locations. After defining an area as "P", we waited at least 24 hours before performing the test. The cassette recorder was placed on the ground 15 m from the nest or roost tree in a direction that afforded the passerines a perching place less than 5 m from the speaker. The blind was equidistant from the speaker and the roost in an area that provided good visual coverage of both locations.

After setting up test equipment, we conducted a five-minute precount of passerines in the area from inside the blind. After starting the tape, a one-minute silent period allowed time to return to the blind. During the five minutes of Screech Owl playback, the following data were recorded: (1) the orientation and species of the first bird (initial response), (2) the number and species of birds orienting to the nest or roost, (3) the number and species of birds orienting to the speaker, and (4) the number and species of birds whose orientation could not be determined. A bird was considered to be orienting to the nest or roost if it perched in the nest or roost tree or within a 5 m radius of it. Birds that perched within a 5 m radius of the recorder were listed as orienting to the speaker. Birds that passed through the test area or failed to perch within a 5 m radius of either location were counted as undetermined orienters.

Twelve "O" locations were selected by driving along rural roads in the study area, picking good bird habitat, and using the call-back method to check for Screech Owls. If there was no owl response, the area was defined as an "O" location. At least 24 hours elapsed before testing began. At each site, a prominent tree was selected the "O" location. The cassette recorder was placed 15 m from the tree in a direction that afforded passerines a place to perch that was less than 5 m from the speaker. Test procedures at "O" locations were identical to those used at "P" locations.

A score, based on the ratio of passerines orienting to the speaker to the total number of mobbing passerines × 10, was assigned to each "P" and "O" location. A score of 10 means all mobbing passerines oriented to the speaker. A score of 0 means mobbing passerines oriented to the nest or roost. In computing the score for "P" locations, birds with undetermined orientation were counted as orienting to the speaker. The Mann-Whitney U Test (Siegel 1956) was used to analyze the data.

Results

Ninety-two percent of the passerines (see table 1) that responded to tests in "P" locations oriented to the nest or roost tree (table 2). The first individual to respond during each test oriented to the tree cavity rather than the source of sound. In "O" locations, all responding passerines oriented to the speaker with initial responders heading directly toward the sound source (table 3). Mobbing orientation of passerines in "P" and "O" locations differed significantly ($P<0.01$). In seven "O" locations the test tree contained a suitable cavity (table 3). When comparing only those seven "O" locations with "P" locations, they were still significant ($P<0.01$).

The 12 "P" locations included two abandoned nests, two roost sites, three inactive nests, and five active nests (table 2). During tests at both abandoned Screech Owl nests, passerines still oriented to the nest during mobbing when induced by the tape presentation. The two abandoned nests were active earlier in the 1976 nesting season. They were abandoned after the death of one of the paired adults. Testing was conducted three months after the last sighting of a Screech Owl at one location, and five months after the cavity was abandoned at the second.

The three inactive nests were 1976 nests of Screech Owls that were used as fall and winter roost cavities. Screech Owls were present in cavities of two inactive nests during the tests. A Screech Owl called from one cavity during the last minute of the five-minute recording. While tests were conducted at the five active Screech Owl nests, the owls were present in the cavities. They were not flushed from the area by the mobbing activity of the passerines.

Table 1. Passerine Species Responding to Tests in "P" and "O" Locations

Great Crested Flycatcher (*Myiarchus crinitis*)
Eastern Phoebe (*Sayornis phoebe*)
Eastern Wood Pewee (*Contopus virens*)
Blue Jay (*Cyanocitta cristata*)
Carolina Chickadee (*Parus carolinensis*)
Tufted Titmouse (*Parus bicolor*)
Red-breasted Nuthatch (*Sitta canadensis*)
Brown-headed Nuthatch (*Sitta pusilla*)
Brown Creeper (*Certhia familiaris*)
Winter Wren (*Troglodytes troglodytes*)
Carolina Wren (*Thryothorus ludovicianus*)
Mockingbird (*Mimus polyglottos*)
Gray Catbird (*Dumetella carolinensis*)
Brown Thrasher (*Toxostoma rufum*)
American Robin (*Turdus migratorius*)
Wood Thrush (*Hylocichla mustelina*)
Hermit Thrush (*Catharus guttatus*)
Veery (*Catharus fuscescens*)
Eastern Bluebird (*Sialia sialis*)
Blue-gray Gnatcatcher (*Polioptila caerulea*)
Golden-crowned Kinglet (*Regulus satrapa*)
Ruby-crowned Kinglet (*Regulus calendula*)
Cedar Waxwing (*Bombycilla cedrorum*)
White-eyed Vireo (*Vireo griseus*)
Red-eyed Vireo (*Vireo olivaceus*)
Black and White Warbler (*Mniotilta varia*)
Magnolia Warbler (*Dendroica magnolia*)
Yellow-rumped Warbler (*Dendroica coronata*)
Pine Warbler (*Dendroica pinus*)
Prairie Warbler (*Dendroica discolor*)
Ovenbird (*Seiurus aurocapillus*)
Common Yellowthroat (*Geothlypis trichas*)
House Sparrow (*Passer domesticus*)
Orchard Oriole (*Icterus spurius*)
Summer Tanager (*Piranga rubra*)
Cardinal (*Cardinalis cardinalis*)
Indigo Bunting (*Passerina cyanea*)
Purple Finch (*Carpodacus purpureus*)
American Goldfinch (*Carduelis tristis*)
Rufous-sided Towhee (*Pipilo erythrophthalmus*)
Dark-eyed Junco (*Junco hyemalis*)
Chipping Sparrow (*Spizella passerina*)
Field Sparrow (*Spizella pusilla*)
White-throated Sparrow (*Zonotrichia albicollis*)

1

Table 2. Results of Tests in 12 Known Nest or Roost Sites ("P" Locations)

Test Month	Type Site[1]	Initial Response[2]	No. of Birds Orienting to Speaker	No. of Birds Orienting to Tree	No. of Birds of Undetermined Orientation[3]	Score[4]
Aug	Inactive	T	0	21	2	1
Sep	Roost	T	0	6	2	3
Oct	Abandoned	T	0	4	3	4
Oct	Abandoned	T	0	6	1	1
Nov	Roost	T	0	7	1	1
Dec	Inactive	T	0	5	0	0
Dec	Inactive	T	0	7	0	0
Apr	Active	T	0	11	0	0
Apr	Active	T	0	15	0	0
Apr	Active	T	0	3	0	0
May	Active	T	0	9	0	0
May	Active	T	0	8	0	0

[1] "Active," "inactive," and "abandoned" refer to nests.
[2] T = To the nest or roost tree.
[3] Birds of undetermined orientation were counted as orienting to speaker.
[4] See Materials and Methods for explanation of score.

Discussion

The dramatic difference in mobbing response at "O" and "P" locations occurred because of the pairing of the predator's call with the location of the predator's nest or roost. Orientation to the speaker in every "O" location was released only by the playback of the predator's call. Although sound was the only stimulus required to produce

Table 3. Results of Tests in 12 "O" Locations

Test Month	Initial Response[1]	No. of Birds Orienting to Speaker	No. of Birds Orienting to Tree	No. of Birds of Undetermined Orientation	Score[2]
Aug	S	5	0	0	10
Sep	S	8	0	0	10
Oct	S	8	0	0	10
Oct	S	10[*]	0	0	10
Nov	S	31	0	0	10
Dec	S	12[*]	0	0	10
Dec	S	4[*]	0	0	10
Apr	S	6[*]	0	0	10
Apr	S	5[*]	0	0	10
Apr	S	16	0	0	10
May	S	7[*]	0	0	10
May	S	11[*]	0	0	10

[1] S = To the speaker.

[2] See Materials and Methods for explanation of score.

[*] The test was conducted with the simulated nest or roost tree having a cavity.

mobbing in "P" locations, the apparent goal of the mobbing passerines was a known predator's nest or roost even when it was no longer being used by the owl. This behavior supports the hypothesis that passerines can recognize Screech Owls by calls alone and can associate a Screech Owl's call with its likely location. Our data also indicate that the location of a predator's nest or roost even after abandonment is remembered by some passerines. This agrees with Nice and TerPelkwyk (1941) who observed visual recognition of predators by Song Sparrows (*Melospiza melodia*) and that the sparrows seemed to remember the predators' locations for several months.

Our results support Kruuk's (1976) hypothesis that one function of approaching a predator may be to collect information about a potential enemy. We suggest that by remembering the location of specific predators, passerines would be better able to avoid them.

A prey species has four possible strategies in face of a predator threat: to "do nothing" or freeze, to flee, to attack, or to approach. Birds which literally or seemingly did nothing would be selected against unless their behavior or morphology gave them an advantage in not being recognized as prey. One effective behavioral strategy for prey found near a hunting predator might be to call and immediately freeze (Ficken and Witkin 1977). Perhaps some prey are able to analyze the body language of a predator and thereby anticipate the predator's intentions, thus gaining a selective advantage. Doing nothing in the presence of a disinterested, non-hunting predator should provide no obvious selective disadvantage. Many species observed in our study had protective coloration, yet, although it would cost the least energy, none exhibited a "do nothing" strategy.

Birds are known to flee for cover and freeze when predators fly over (Marler and Hamilton 1966). By fleeing from non-attacking predators, passerines would gain little or no information about the predator (e.g., species characteristics, location, motivational state, etc.) and would be less likely to pass on such information to offspring. Thus they and their offspring might be selected against in subsequent encounters owing to the lack of important recognition cues and experience. Fleeing passerines may also reduce their survival by losing nest and roost cavities to predators who are also competitors for these sites.

Attack (involving physical contact with a predator) would be selected for if prey species drove the intruding predator from the area. Removal might be accomplished providing the prey was larger or more aggressive than the predator or a good bluffer. However, small passerines, individually attacking an intruding owl, might fall easy prey, while collective attack—mobbing—might be successful in removal of the predator. However, because of the risks involved, attacks toward a predator during mobbing would be expected to be uncommon.

Risk is also involved in approaching a predator. Subtle behavioral cues and rapid changes of circumstances perceived during mobbing might, however, be used to full advantage by a prudent passerine to minimize risk during mobbing. But what selective advantages would be gained from such a risk? Single approaching birds would probably not be very successful in removing potential nesting competitors such as the Screech Owl who were also predators. Successful removal could be achieved by being large and aggressive or by attracting other passerines so that by numbers alone there would be an appearance of large size. Flocks of birds are known to compress in size to give the appearance of large size or to make it more difficult for predators to single out individuals (Tinbergen 1951). The effect of a larger, more aggressive species might discourage predation and produce conflict behavior in the predators or actual flight, depending on the situation. Thus Cully and Ligon (1976) and Shedd (1978) state that mobbing functions to reduce danger to breeding birds and their young or to permanent residents by moving predators away from the area. We ask, "To where?" It seems reasonable that predators have territories that are sympatric with passerines. It is not likely that passerines could remove an avian predator such as an owl from an area in which the owl is also foraging or nesting. We are unaware of any studies documenting the frequency at which predators are even temporarily removed or foiled in their predatory behavior owing to mobbing by passerines. While permanent removal seems unlikely, temporary removal of a predator would be advantageous since the likelihood of predation is lessened. Even if the predator is not chased off, mobbing may function as a communicative device, signaling to community members the location of a predator (Hinde 1966).

In every test conducted in a "P" location, initial response was to orient within the 5 m radius of the cavity tree. Under the null hypothesis, the first bird to react to the owl call had an equal chance of orienting to the sound source. That the first individual in each case did not, shows that the initial orientation was toward a known location of a predator. The behavior of this first experienced individual seemed to indicate to other birds the learned probable location of the predator. In the Black-capped Chickadee (*Parus atricapillus*) certain experienced adults may be especially important in alerting group members to nearby predators (Ficken and Witkin 1977).

In several of the tests some of the mobbing passerines were clearly naive. Yet in every test at a "P" location, no bird chose to orient to the source of the sound. Such a response of a naive passerine socially facilitated by the first individual's behavior, would be adaptive, because the participant presumably received important information about a predator by mobbing toward a known Screech Owl cavity.

Ficken and Witkin (1977) suggested that young and inexperienced birds that associated with experienced adults seemed to benefit from signals given by experienced adults when predators were near. Curio et al. (1978) showed cultural transmission to be one function of mobbing in captive European Blackbirds (*Turdus merula*). We suggest that approach during mobbing would be selected for primarily because of the learning involved. The social event of mobbing gives a group of potential prey species experience with a predator and its location, making predation in that particular area more difficult.

The evidence presented in our study lends support to an explanation of the evolution of mobbing behavior. Never have we observed that the act of mobbing an owl results in the removal of the owl from the area. Therefore, it seems highly unlikely that the main function of mobbing behavior is to remove the owl. Passerines are highly territorial and often aggressively display against intruders of other species (Orians and Wilson 1964). The evolution of displacement behavior into an adaptive communicative display was proposed by Tinbergen (1952) as an explanation for the social displays of many gull species. Marler (1956) hypothesized that mobbing in Chaffinches (*Fringilla coelebs*) resulted from the conflict between approach and avoidance behavior stimulated by the presence of a predator. We suggest that mobbing may have evolved from the fight-flight conflict during territorial encounters with predators. This conflict behavior may have become adaptive in predator avoidance and evolved as a device to communicate via a social display that not only can confuse a predator, but can give community members an opportunity to learn about it.

While mobbing may produce fringe benefits such as distracting or confusing a predator or temporarily removing it from the area, there is accumulating evidence that knowledge of who a predator is and where it is most likely to be found gives potential prey a greater selective advantage.

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Literature Cited

Allen, A. A. 1924. A contribution to the life history and economic status of the Screech Owl (*Otus asio*). *Auk* 41:1–16.

Bangs, O. 1930. The Screech Owls of eastern North America. *Auk* 47:403–404.

Bent, A. C. 1938. *Life histories of North American birds of prey.* Part II. Dover, New York. 482 pp.

Cully, J. F., Jr., and J. D. Ligon. 1976. Comparative mobbing behavior of Scrub and Mexican Jays. *Auk* 93:116–125.

Curio, E., U. Ernst, and W. Vieth. 1978. Cultural transmission of enemy recognition: one function of mobbing. *Science* 202:899–901.

Dodsworth, P. T. L. 1910. Mental powers of animals. *Zoologist* 14:361–376.

Ficken, M. S., and S. R. Witkin. 1977. Response of Black-capped Chickadee flocks to predators. *Auk* 92:156–157.

Hamerstrom, F. 1957. The influence of a hawk's appetite on mobbing. *Condor* 59:192–194.

Hartley, P. H. T. 1950. An experimental analysis of interspecific recognition. *Symp. Soc. Exp. Biol.* 4:313–336.

Hinde, R. A. 1954. Factors governing the changes in strength of a partially inborn response, as shown by the mobbing behaviour of the Chaffinch (*Fingilla coelebs*). I. The nature of the response, and an examination of its course. *Proc. Roy. Soc. Lond.*, B. 142:306–331.

Hinde, R. A. 1966. *Animal behaviour.* McGraw-Hill, New York. 876 pp.

Hough, T. 1960. Two significant calling periods of the Screech Owl. *Auk* 77:227–228.

Kruuk, H. 1976. The biological function of gull's attraction towards predators. *Anim. Behav.* 24:146–153.

LeCroy, M. 1975. Easily built portable blind. *Bird-Banding* 46:166–168.

Lorenz, K. 1938. A contribution to the comparative sociology of colonial nesting birds. *Proc. 8th Intern. Ornithol. Congr.* pp. 206–218.

Marler, P. 1956. Behaviour of the Chaffinch, *Fringilla coelebs. Behaviour Suppl.* 5:1–184.

Marler, P., and W. J. Hamilton, III. 1966. *Mechanisms of animal behavior.* Wiley, New York. 771 pp.

Miller, L. 1952. Auditory recognition of predators. *Condor* 54:89–92.

Nice, M. M., and J. TerPelkwyk. 1941. Enemy recognition by the Song Sparrow. *Auk* 58:195–214.

Orians, G., and M. F. Wilson. 1964. Interspecific territoriality of birds. *Ecology* 45:736–745.

Pearson, T. G., C. S. Brimley, and H. H. Brimley. 1959. *Birds of North Carolina.* Rev. ed. by D. L. Wray and H. T. Davis. N. C. State Mus. Nat. Hist., Raleigh. 434 pp.

Rand, A. L. 1941. Development and enemy recognition of the Curve-billed Thrasher, *Toxostoma curvirostre. Bull. Amer. Mus. Nat. Hist.* 78:213–242.

Robbins, C. S., B. Bruun, and H. S. Zim. 1966. *Birds of North America.* Golden Press, New York. 340 pp.

Shedd, D. H. 1978. The adaptive significance of avian mobbing behavior. Ph.D. dissertation, Cornell University, Ithaca, N.Y. 193 pp.

Siegel, S. 1956. *Nonparametric statistics for the behavioral sciences.* McGraw-Hill, New York. 312 pp.

Smith, J. M., and H. B. Graves. 1978. Some factors influencing mobbing behavior in Barn Swallows (*Hirundo rustica*). *Behav. Biol.* 23:355–372.

Stewart, P. A. 1969. Prey in two Screech Owl nests. *Auk* 86:141.

Tinbergen, N. 1951. *The study of instinct.* Oxford Univ. Press, Oxford. 228 pp.

Tinbergen, N. 1952. "Derived" activities; their causation, biological significance, origin, and emancipation during evolution. *Qt. Rev. Biol.* 27:1–32.

VanCamp, L. F., and C. J. Henny. 1975. The Screech Owl: Its life history and population ecology in northern Ohio. *N. Amer. Fauna* No. 71. 65 pp.

Wetmore, A. 1965. *Water, prey and game birds of North America.* Nat. Geo. Soc., Washington, D.C. 464 pp.